



Clinicodemographic Profile of Childhood Cancer in a Mining State, Odisha: A Retrospective Analysis

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Abstract

Introduction Pediatric malignancy represents 5% of total cancer diagnosed in India. Due to delayed diagnosis and inaccessibility to healthcare system, the overall outcome is poor in our country. The clinicodemographic profile of childhood malignancy is well described in the Western world and in certain parts of India. The incidence of pediatric malignancy in Eastern India, especially Odisha, has not yet been reported that has motivated us to conduct such a study.

Objective This study aims to evaluate the clinicodemographic profile and pattern of childhood malignancy among pediatric patients who received the treatment at a tertiary cancer institute of Odisha.

Materials and Methods It was a retrospective observational study, carried out for a period of 8 years, from January 1, 2013 to December 31, 2020 at a tertiary cancer center in Eastern India. A total of 759 eligible childhood malignancy patients were recruited in the study. IBM SPSS v23 was used for descriptive statistical analysis, that is, number and percentage of various clinicodemographic parameters of the above patients.

Result Childhood malignancy accounted for 1.6% of all cancers reported during the above study period. The male to female ratio was 1.8:1. Out of 759 eligible childhood cancer patients, majority of patients were suffering from leukemia (173; 22.8%) followed by malignant bone tumors (137; 18.0%), and lymphoma (122; 16%). Leukemia was predominant in the age group of 0 to 14 years; lymphoma, central nervous system neoplasms, germ cell tumors malignant bone tumors, and soft tissue sarcoma (STS) were common in the age group of 10 to 18 years; neuroblastoma, retinoblastoma, and renal and hepatic tumors were seen commonly in the age group of 0 to 9 years. The most common presentation in leukemia was fever, while lymphadenopathy was the chief complaint in lymphoma. Local swelling and pain were the presenting symptoms in malignant bone tumors, while STS patients had painless swelling.

Conclusion This study provides an overview of the burden and pattern of childhood malignancy for the state of Odisha and acts as a roadmap for the clinicians to conduct further research in the field of pediatric oncology.

Keywords

- pediatric malignancy
- Eastern India
- childhood leukemia

Introduction

According to the World Health Organisation, childhood cancer is defined as any cancer arising in children aged between 0 and 19 years. Nearly 4 lakh children are diagnosed with cancer every year globally.¹ The cure rate in childhood malignancy has improved from less than 10% in 1950s to about 80% in present day due to better understanding of biology and proper implementation of multidisciplinary treatment approach.²

In India, approximately 45,000 new cases of childhood malignancy are detected each year that accounts for 5% of total cancer burden.³ The cure rate of childhood malignancies in India ranges from 10 to 30% that is quite low as compared to 80% in developed countries.⁴ Last few decades have witnessed strengthening of healthcare services for treatment of childhood cancers in India, but these services are mostly confined to tertiary cancer centers. Due to absence of nation-wide population-based cancer registry (PBCR), there is lack of data about the exact burden of childhood cancer in India. Further, the existing PBCRs mostly cater data about prevalence of malignancies in the urban population.⁵ Hence, there is a need to accurately define the burden of childhood cancers in India.

Childhood malignancies include a spectrum of diseases whose clinical and demographic picture varies from country to country and also inter-regionally within the same country. In India, children with cancer are detected at an older age with advanced stage, likely due to poor awareness and delay in diagnosis that further leads to delay in treatment. In addition, lack of appropriate supportive care, treatment refusal, and abandonment are the main hurdles to such low cure rate in the country.⁵

Publications on childhood cancer are few from India and scarce from the eastern zone. The lack of clinicodemographic data of childhood malignancy from the state of Odisha has driven us to conduct such a study that will highlight the cancer burden in children in the state of Odisha and also act as a stimulus for all the oncologists and pediatrician for further health-related research in the field of pediatric malignancies.

Materials and Methods

Study design: This was a retrospective observational study was conducted in the month of July 2021 by the department of medical oncology in conjunction with the department of radiation oncology at a tertiary cancer center of Odisha. All childhood cancer patients who received treatment during the period January 1, 2013 to December 31, 2020 were included for screening.

Inclusion criteria: Residents of Odisha with histopathology or flow cytometry proved malignancy were included in this study.

Exclusion criteria: Patients aged more than 18 years were excluded from the study.

Data: The complete demographic and clinical data of the eligible patients such as age, sex, year of admission to our

institute, clinical histories, presenting symptoms, and duration of symptoms were collected from clinical case sheets from medical record section of our institute. The final study population of pediatric malignancy after screening of data during this period was 759 as shown in flow diagram in ►Fig. 1. The primary outcome measure was to find out the pattern of distribution of childhood malignancies in a mining state, Odisha. The secondary outcome measure was to correlate any difference in distribution of childhood malignancies with that of national and international level.

Statistical Analysis

The number and percentage of male, female, and district-wise distribution of childhood cancers were calculated for this study period. The distribution of childhood cancers was further done into four major age groups—0 to 4 years, 5 to 9 years, 10 to 14 years, and 15 to 18 years according to the third edition of the International Classification of Childhood Cancers (ICCC-3). The number and percentage of common presenting symptoms and the median duration of symptoms of various malignancy were studied. International Business Machine (IBM) Statistical Package for the Social Sciences (SPSS) version 23 was used for the above descriptive study of data.

Ethics approval: Permission from the Institutional Ethics Committee was received on June 3, 2021 via letter no. 05-IEC-AHPGIC. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Results

During the study period from January 2013 to December 2020, 47,678 patients of our state were admitted to the tertiary cancer center out of which 759 belonged to the pediatric age (0–18 years). Highest number of pediatric cancer patients were admitted in the year 2016 (141), while lowest was in the year 2020 (57) as shown in ►Table 1. The prevalence of malignancy was more among males than females with an overall male: female ratio of 1.8:1 (95% confidence interval: 1.3–2.3).

On analysis of the district-wise distribution of childhood cancers as depicted in ►Table 2, highest frequency of childhood cancer was from the district of Mayurbhanj (79, 10.41%), followed by Ganjam (60, 7.91%), Cuttack (50, 6.59%), Jajpur (47, 6.20%), Balasore (40, 5.27%), Balangir (39, 5.14%) Puri (38, 5.01%), and Khordha (37, 4.87%), while only two (0.26%) cases of childhood malignancy were admitted to our center from the district of Deogarh during the study period.

In this study, on analysis of the type of malignancy in ►Table 3, it was observed that childhood leukemia was the commonest type of childhood malignancy constituting 173 (22.8%) patients followed by malignant bone tumors 137 (18.0%) and lymphoma 122 (16.1%). The least common malignancy was retinoblastoma constituting only 11 (1.4%)

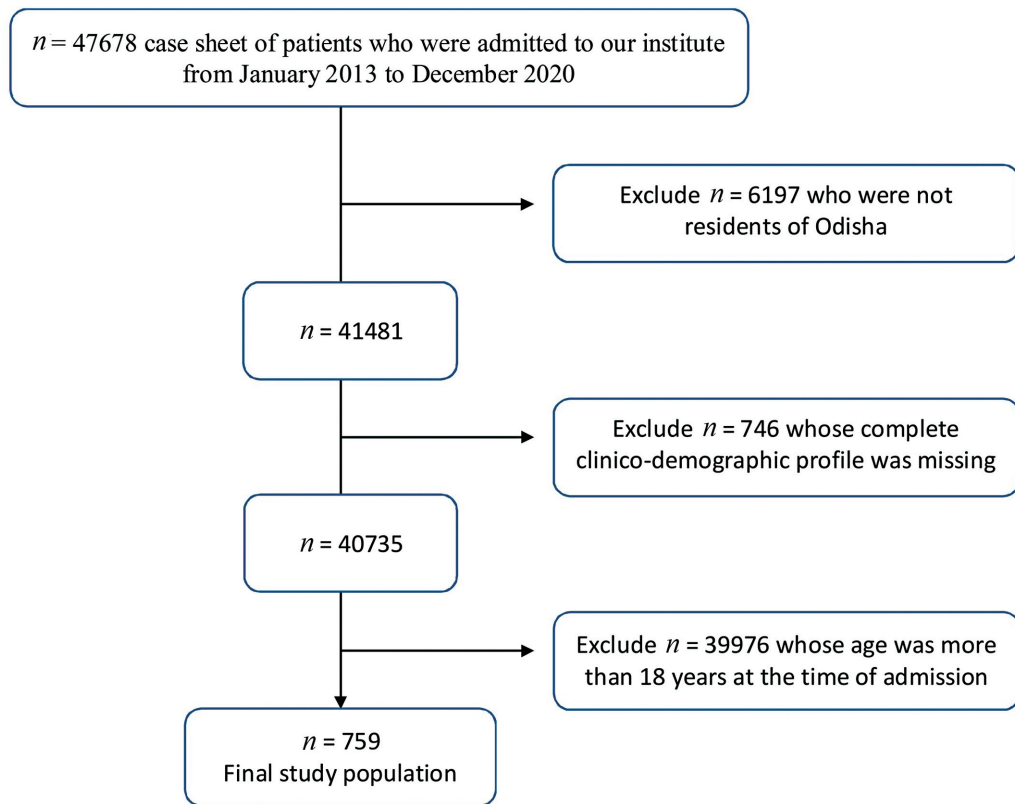


Fig. 1 The flowchart depicting screening process of the final study population.

Table 1 The year and gender distribution and frequency of childhood cancers from 2013 to 2020

| Year | Total no. of cases | No. of childhood cancers | Frequency (%) | Male | Female | Male:female ratio |
|-------|--------------------|--------------------------|---------------|------|--------|-------------------|
| 2013 | 4,968 | 94 | 1.9 | 73 | 21 | 3.47 |
| 2014 | 5,981 | 102 | 1.7 | 66 | 36 | 1.83 |
| 2015 | 5,769 | 131 | 2.3 | 78 | 53 | 1.47 |
| 2016 | 6,032 | 141 | 2.3 | 97 | 44 | 2.20 |
| 2017 | 6,647 | 92 | 1.4 | 60 | 32 | 1.87 |
| 2018 | 7,072 | 83 | 1.2 | 46 | 37 | 1.24 |
| 2019 | 6,519 | 59 | 0.9 | 35 | 24 | 1.46 |
| 2020 | 4,690 | 57 | 1.2 | 33 | 24 | 1.37 |
| Total | 47,678 | 759 | 1.6 | 488 | 271 | 1.80 |

patients. On analysis, it was observed that in the age group of 0 to 4 years, childhood leukemia was the most common malignancy 45 (5.9%) followed by renal tumors 36 (4.7%), central nervous system (CNS) neoplasms 15 (1.9%), and lymphoma 13 (1.7%). In this age group, the incidence of malignant bone tumors was the least with only four (0.5%) patients. In the age group 5 to 9 years, childhood leukemia also was the commonest malignancy 43 (5.6%) followed by CNS neoplasm 29 (3.8%) and lymphoma 26 (3.4%), while hepatic tumors was the lowest with only three (0.4%) patients. In the age group 10 to 14 years, again the predominance of childhood leukemia was noted among all malignancy with 52 patients (6.8%), followed by lymphoma 47 (6.2%)

and malignant bone tumors with 43 (5.6%) patients. Malignant bone tumor was the most frequent malignancy 70 (9.2%) in the adolescent age group of 15 to 18 years, followed by lymphoma in 36 patients (4.7%) and leukemia in 33 patients (4.3%) and germ cell tumors in 20 patients (2.6%).

Among childhood leukemia, acute lymphoblastic leukemia (ALL) was the most common malignancy 132 (76.3%) in all the groups, followed by acute myelogenous leukemia (AML) 33 (19.0%) and chronic myelocytic leukemia 8 (4.7%). There was a predominance of non-Hodgkin lymphoma (HL; 68 patients) over HL (54 patients). Medulloblastoma was the most common CNS neoplasms (30 patients). Ewing sarcoma (ES) had the highest frequency among malignant

Table 2 The district-wise distribution of childhood cancers from 2013 to 2020

| District | Total childhood cancers | Frequency (%) |
|---------------|-------------------------|---------------|
| Anugul | 12 | 1.58 |
| Balangir | 39 | 5.14 |
| Balasore | 40 | 5.27 |
| Bargarh | 30 | 3.95 |
| Bhadrak | 34 | 4.48 |
| Boudh | 15 | 1.98 |
| Cuttack | 50 | 6.59 |
| Deogarh | 2 | 0.26 |
| Dhenkanal | 22 | 2.90 |
| Gajapati | 8 | 1.05 |
| Ganjam | 60 | 7.91 |
| Jagatsinghpur | 20 | 2.64 |
| Jajpur | 47 | 6.20 |
| Jharsuguda | 6 | 0.79 |
| Kalahandi | 21 | 2.77 |
| Kandhamal | 16 | 2.11 |
| Kendrapara | 35 | 4.61 |
| Keonjhar | 31 | 4.08 |
| Khordha | 37 | 4.87 |
| Koraput | 14 | 1.84 |
| Malkangiri | 8 | 1.05 |
| Mayurbhanj | 79 | 10.41 |
| Nabarangpur | 7 | 0.92 |
| Nayagarh | 19 | 2.50 |
| Nuapada | 5 | 0.66 |
| Puri | 38 | 5.01 |
| Rayagada | 7 | 0.92 |
| Sambalpur | 18 | 2.37 |
| Sonepur | 21 | 2.77 |
| Sundargarh | 18 | 2.37 |

bone tumor (67 patients) followed by osteosarcoma (66 patients). Among soft tissue sarcoma (STS), maximum cases reported were of rhabdomyosarcoma (RMS; 32 patients). Other epithelial tumors reported in this study include carcinoma nasopharynx (10 patients), carcinoma recto-sigmoid region (4 patients), Langerhans cell histiocytosis (4 patients), carcinoma stomach, ovary, and melanoma (1 patient each).

In this study, fever was the most common presenting symptom seen in 129 patients (74.6%) out of total 173 patients of childhood leukemia, followed by generalized weakness in 47 patients (27.2%), bleeding manifestation in 22 patients (12.7%), and joint pain in 3 patients (1.7%) as depicted in **Table 4**. Lymphadenopathy was the commonest presentation of lymphoma (82 patients, 67.2%) followed by

fever (36, 29.5%) and pain abdomen (19, 15.6%). Majority of the CNS neoplasms presented with vomiting (86, 94.5%) and headache (49, 53.8%). Other presentation included fever and seizure. Patients of neuroblastoma presented with abdominal lump (9; 52.9%) followed by pain abdomen (3; 17.6%), fever (3; 17.6%), and seizure (1; 5.9%). Maximum children (10, 90.9%) with retinoblastoma had swelling of unilateral eye as the most common presentation, while only one (9.1%) child presented as bilateral retinoblastoma. Out of 56 renal tumors (Wilms tumor [WT]) detected during the study period, maximum (51, 91.1%) patients had abdominal swelling as their common presentation. Abdominal lump was also the most common presentation of the hepatic tumors seen in eleven patients (73.3%) followed by pain abdomen seen in seven patients (46.7%), fever in two patients (13.3%), and vomiting in one patient (6.7%) only. Among 137 cases of malignant bone tumors included in the study, maximum (125 patients; 91.2%) presented with local swelling followed by pain at local site seen in 20 patients (14.6%). Soft tissue tumors in children (total 42 patients) presented with local swelling as their most common presentation in 31 patients (73.8%), pain at local site in 6 patients (14.3%), and blood in urine in 4 patients (9.5%). Also, in 45 childhood germ cell tumors, majority of patients 22 (48.9%) presented with abdominal swelling followed by pain abdomen (18 patients; 40%) and scrotal swelling (8 patients; 17.7%).

The median duration of symptoms was 1 month for childhood leukemia, CNS tumors, neuroblastoma, retinoblastoma, and germ cell tumors, while it was 2 months for lymphoma, renal tumors, hepatic tumors, bone and soft tissue tumors, and other malignant epithelial tumors.

Discussion

In India, the pivotal role in cancer registration is mostly accomplished by PBCR and hospital-based cancer registries (HBCRs). Currently, there are 33 PBCRs and 101 HBCRs in India. The latest data on the burden of cancer in India was reported by 27 PBCRs for the years 2012 to 2014 that covered only 10% of the population.⁶ Therefore, the exact burden of cancer in India is lacking due to nonavailability of nation-wide PBCR. Behera et al have highlighted the lacunae of the existing PBCRs that include dominance of urban cases being reported over rural, lack of quality assurance for data, loss to follow-up, and absence of survival data. Further the cost of registration in PBCR is high and there is no link between one PBCR with the others.⁷ All these loopholes need to be addressed in order to increase the cancer case registration that will help in predicting the burden of cancer in Indian children.

Steliarova-Foucher et al evaluated 153 population-based registries from 62 countries during the period 2001 to 2010 and reported that the global incidence of malignancy in children aged between 0 and 19 years was 3,85,509 that accounted for 2.64 billion person-years.⁸ According to 3 years (2012–2014) report of 27 PBCRs of India, the proportion of childhood cancer for the age group of 0 to 14 years ranged from 0.7 to 4.4% as compared to cancers in all groups.⁹ In this study from 2013 to 2020, the proportion of childhood cancer

Table 3 The distribution of childhood cancers according to four major age groups

| Types of cancer | Age group (in years) | | | | Total |
|--------------------------------------|----------------------|-----|-------|-------|-------|
| | 0-4 | 5-9 | 10-14 | 15-18 | |
| Leukemia | 45 | 43 | 52 | 33 | 173 |
| ALL | 39 | 36 | 34 | 23 | 132 |
| AML | 6 | 6 | 15 | 6 | 33 |
| CML | 0 | 1 | 3 | 4 | 8 |
| Lymphoma | 13 | 26 | 47 | 36 | 122 |
| Hodgkin lymphoma | 3 | 15 | 22 | 14 | 54 |
| Non-Hodgkin lymphoma | 10 | 11 | 25 | 22 | 68 |
| CNS neoplasms | 15 | 29 | 29 | 18 | 91 |
| Medulloblastoma | 6 | 14 | 7 | 3 | 30 |
| High-grade gliomas | 3 | 3 | 6 | 5 | 17 |
| Low-grade gliomas | 2 | 4 | 6 | 3 | 15 |
| Craniopharyngioma | 1 | 3 | 6 | 3 | 13 |
| Meningioma | 0 | 0 | 0 | 2 | 2 |
| Ependymoma | 2 | 4 | 1 | 1 | 8 |
| Gliosarcoma | 0 | 0 | 1 | 0 | 1 |
| Intracranial embryonal tumor | 0 | 1 | 1 | 1 | 3 |
| Germinoma | 0 | 0 | 1 | 0 | 1 |
| Pinealoblastoma | 1 | 0 | 0 | 0 | 1 |
| Neuroblastoma | 8 | 7 | 1 | 1 | 17 |
| Retinoblastoma | 7 | 4 | 0 | 0 | 11 |
| Renal tumors (Wilms' tumor) | 36 | 15 | 3 | 2 | 56 |
| Hepatic tumors (hepatoblastoma) | 8 | 3 | 3 | 1 | 15 |
| Malignant bone tumors | 4 | 20 | 43 | 70 | 137 |
| Osteosarcoma | 0 | 6 | 18 | 42 | 66 |
| Ewing sarcoma | 4 | 14 | 23 | 26 | 67 |
| Chondrosarcoma | 0 | 0 | 1 | 0 | 1 |
| Giant cell tumor | 0 | 0 | 1 | 2 | 3 |
| Soft tissue sarcomas | 10 | 5 | 11 | 16 | 42 |
| Rhabdomyosarcoma | 8 | 5 | 10 | 9 | 32 |
| Fibrosarcoma | 1 | 0 | 0 | 1 | 2 |
| Epithelioid sarcoma | 1 | 0 | 0 | 1 | 2 |
| Synovial sarcoma | 0 | 0 | 1 | 3 | 4 |
| Peripheral nerve sheath tumor | 0 | 0 | 0 | 2 | 2 |
| Germ cell tumors | 9 | 9 | 7 | 20 | 45 |
| Other malignant epithelial neoplasms | 10 | 6 | 11 | 23 | 50 |
| Carcinoma nasopharynx | 0 | 0 | 3 | 7 | 10 |
| Carcinoma ovary | 0 | 0 | 0 | 1 | 1 |
| Carcinoma rectosigmoid | 0 | 0 | 0 | 4 | 4 |
| Carcinoma stomach | 0 | 0 | 0 | 1 | 1 |
| Malignant melanoma | 0 | 0 | 0 | 1 | 1 |
| Langerhans cell histiocytosis | 3 | 0 | 1 | 0 | 4 |
| Others unspecified carcinoma | 7 | 6 | 7 | 9 | 29 |
| Total | 165 | 167 | 207 | 220 | 759 |

Abbreviations: ALL, acute lymphoblastic leukemia; AML, acute myelogenous leukemia; CML, chronic myelocytic leukemia; CNS, central nervous system.

for the age group of 0 to 18 years was 1.6% as compared to malignancy of all age groups that is in concordance with that of the Indian data. The childhood cancer patients reporting for treatment to our institute were maximum (141) in year 2016 and minimum (57) during the year 2020. The probable reason being less patients seeking healthcare due to nation-wide lockdown in India due to the coronavirus disease 2019 pandemic.

Globally, the male to female ratio of pediatric malignancy in the age group of 0 to 19 years was 1.14:1, while 1.17:1 in the age group of 0 to 14 years, which suggests the male predominance.⁸ The data on overall male to female ratio is lacking in PBCR report of 2012 to 2014. However, the proportion of pediatric malignancy among the male child was highest (5.4%) in PBCR of Delhi, while it was lowest (0.7%) in PBCR of Nagaland. Similarly, among the female child, the

Table 4 The common clinical presentation and median duration of symptoms of childhood malignancies

| Type of malignancy | Symptoms | Number of patients (%) | Median duration of symptoms (in months) |
|-------------------------|---|--|---|
| Leukemia | Fever Generalized weakness Facial swelling Pain abdomen Bleeding manifestation Abdomen swelling Jaundice Joint pain Breathlessness, cough Vomiting | 173 129 (74.6%) 47 (27.2%) 25 (14.4%) 17 (9.8%) 22 (12.7%) 12 (6.9%) 2 (1.2%) 3 (1.7%) 7 (4.0%) 7 (4.0%) | 1 |
| Lymphoma | Lymphadenopathy Fever Pain abdomen Breathlessness, cough, chest pain | 122 82 (67.2%) 36 (29.5%) 19 (15.6%) 16 (13.1%) | 2 |
| CNS tumors | Vomiting Headache Fever Seizure | 91 86 (94.5%) 49 (53.8%) 2 (2.2%) 2 (2.2%) | 1 |
| Neuroblastoma | Abdomen swelling Pain abdomen Swelling over scalp Swelling over eye Fever Seizure | 17 9 (52.9%) 3 (17.6%) 1 (5.9%) 2 (11.7%) 3 (17.6%) 1 (5.9%) | 1 |
| Retinoblastoma | Swelling of unilateral eye Swelling of bilateral eye Fever | 11 10 (90.9%) 1 (9.1%) 1 (9.1%) | 1 |
| Renal tumors | Abdominal mass Pain abdomen Fever Blood in urine Vomiting | 56 51 (91.1%) 7 (12.5%) 4 (7.1%) 1 (1.8%) 1 (1.8%) | 2 |
| Hepatic tumors | Abdomen mass Pain abdomen Fever Vomiting | 15 11 (73.3%) 7 (46.7%) 2 (13.3%) 1 (6.7%) | 2 |
| Malignant bone tumors | Local swelling Pain at local site Fever Breathlessness, cough Vomiting, headache | 137 125 (91.2%) 20 (14.6%) 3 (2.2%) 4 (2.9%) 1 (0.7%) | 2 |
| Soft tissue tumors | Local swelling Pain at local site Blood in urine Breathlessness, cough | 42 31 (73.8%) 6 (14.3%) 4 (9.5%) 2 (4.7%) | 2 |
| Germ cell tumors | Abdomen swelling Pain abdomen Scrotal swelling Breathlessness, cough Vomiting | 45 22 (48.9%) 18 (40%) 8 (17.7%) 4 (8.9%) 2 (4.4%) | 1 |
| Other epithelial tumors | | 50 | 2 |

Abbreviation: CNS, central nervous system.

proportion of pediatric malignancy was highest (3.5%) in PBCR of Naharlagun (excluding the district of Papumpare) and was lowest (0.5%) in PBCR of Meghalaya (in East Khasi Hills District).⁹ In this study, the male:female ratio was 1.80:1 highlighting the male predominance of pediatric malignancy.

During the above study period, maximum number of childhood cancer patients were from the district of Mayurbhanj, Ganjam, Cuttack, Jajpur, Balasore, Balangir, Puri, and Khordha. Availability of developed tertiary care hospitals in the above districts of Odisha that leads to increased detection may be the reason for higher cases of pediatric malignancy being detected in above districts as compared to others.

Based on tumor site and morphology, the ICCC-3 has grouped childhood cancers into 11 main categories of childhood malignancy, that is, (i) leukemia, myeloproliferative diseases and myelodysplastic diseases; (ii) lymphoma and reticuloendothelial neoplasms; (iii) CNS and miscellaneous intracranial and intraspinal neoplasms; (iv) neuroblastoma and other peripheral nervous cell tumors; (v) retinoblastoma; (vi) renal tumors; (vii) hepatic tumors; (viii) malignant bone tumors; (ix) soft tissue and other extrasosseous sarcomas; (x) germ cell tumors, trophoblastic tumors and neoplasms of gonads; (xi) other malignant epithelial neoplasms and malignant melanomas.¹⁰

Globally, the commonest malignancy in the age group of 1 to 14 years is childhood leukemia followed by CNS neoplasm and lymphoma, whereas in the age group of 15 to 19 years, the most common neoplasm is lymphoma followed by epithelial tumor and melanoma.⁸ Childhood leukemia is also the most common childhood malignancy in India.⁴ In this study, childhood leukemia was the most common childhood malignancy that was consistent with global and Indian data. In the developed countries, CNS tumor exceeds lymphoma cases, but in India and in our study lymphoma cases were more as compared to childhood CNS neoplasms.¹¹

In India, childhood leukemia represents 40 to 50% of pediatric malignancy and the most common subtype was ALL followed by AML.^{8,11} In this study, leukemia was the most common childhood malignancy constituting 22.8% of all patients. Out of all leukemia patients, ALL was the most predominant childhood leukemia reporting 76.3% of cases. The median age at diagnosis ranged from 6 to 10 years in Indian scenario, while maximum number of patients were seen in the age group of 3 to 14 years in this study.⁵ Childhood leukemia usually present clinically with nonspecific symptoms such as fever that mimics other childhood infectious and parasitic infestations. This lack of recognition of symptoms as any other childhood ailment usually leads to delayed diagnosis of leukemia.¹² The common symptoms of leukemia noted in this study were fever, weakness, bleeding manifestation, and joint pain that were similar to those reported by Prajapati et al.¹³

The incidence of childhood lymphoma in India is quite identical with Western world.⁸ In this study, lymphoma was the third most common malignancy with a total of 122 (16.1%) patients, and was seen in the age groups from 2 to 18 years. The most common type of lymphoma in India was

HL, whereas the non-Hodgkin lymphoma (NHL) was predominant in this study.⁵ Most patients of HL usually present with B symptoms (fever, drenching night sweats and loss of more than 10% of weight in the last 6 months), while NHL patients present commonly with abdominal swelling followed by lymphadenopathy.^{14,15} In this study, lymphadenopathy was the most common presentation in both HL and NHL patients. These patients are often misdiagnosed as tuberculosis that leads to advanced stage at diagnosis.⁵

Jain et al have studied 3,936 pediatric CNS neoplasms patients from seven tertiary cancer hospitals in India and have highlighted astrocytoma histology was the most common primary childhood brain tumor. Others histologies, that is, medulloblastoma, supratentorial primitive neuroectodermal tumors, craniopharyngiomas, and ependymal tumors, were reported in decreasing order of frequency.¹⁶ In our study, out of 91 patients of CNS neoplasms medulloblastoma was the most common CNS malignancy constituting 30 (32.9%) followed by pediatric glioma 17 (18.7%) and astrocytoma 15 (16.5%). The median duration of diagnosis was 1 month. Patients of brain tumors in our study mostly presented in the age group of 2 to 9 years with vomiting, headache, fever, and seizures as the presenting symptoms that correlated with the findings reported by Madhavan et al.¹⁷

Neuroblastoma was considered as the commonest childhood extracranial solid tumor.¹⁸ Neuroblastoma in Indian children ranged from 2.4 to 7.5% as stated in the consolidated report of seven HBCRs 2012 to 2014.¹⁹ In this study, only 17 (2.2%) patients of neuroblastoma were seen out of which two patients (11.8%) had age less than 547 days, while maximum (15 cases; 88.2%) patients had age more than 547 days. Majority (88.2%) of patients of neuroblastoma in our study had age more than 547 days suggestive of poor prognosis.¹⁸ Patients of neuroblastoma usually presented with abdominal swelling, pain abdomen, swelling over scalp, swelling of eye, fever, and seizure as seen in our study.

Retinoblastoma being the commonest primary intraocular tumor has a global incidence of 3 to 5 million children per year. In the developed countries, retinoblastoma represented 2.5 to 4% of all childhood cancers, while it ranged from 6 to 10% of all pediatric malignancies in Indian children.⁸ These patients are diagnosed at median age of 29 months and commonly presented with leukocoria and/or proptosis.²⁰ Only 11 (1.4%) retinoblastoma patients out of the total 759 pediatric patients presented to our institute during the above study period. Patients in the age group of 0 to 4 years were seven, while only four patients were in the age group of 5 to 9 years. Proptosis was the most common presentation with unilateral proptosis seen in 10 patients and bilateral proptosis in only 1 patient.

In pediatric age, the most common renal malignant tumor was WT that accounted for 5.9% of all childhood malignancies. The incidence of WT in Asian population was half of that of the Western population. The median age at diagnosis was 3 years, and the most common presentation was abdominal mass followed by pain abdomen, fever and blood in urine.²¹ In our study out of a total of 56 patients of WT, 36 patients

(64.3%) presented in age group of 1 to 4 years with abdominal mass as the most frequent clinical presentation.

Hepatoblastoma, the most common primary hepatic childhood malignancy, with a global incidence of 1.5 per million children mostly presented at the median age of 11 months. Abdominal mass followed by pain abdomen, fever, jaundice, and vomiting was the clinical presentation at the time of diagnosis.²² During our study period, 15 patients with hepatoblastoma were reported. Majority of patients (8; 53.3%) were in the age group of 0 to 4 years and presented with abdominal mass as their initial presentation that also correlated with the western literature.

ES was the most common primary malignant bone tumor followed by osteosarcoma. Osteosarcoma in pediatric patients was mostly seen during the period of rapid bone growth, that is, second decade. ES was common among Asians as compared to Western population. Local swelling and pain were the most common presenting complaints in all malignant bone tumors.¹⁸ Majority of malignant bone tumors in our study presented in the adolescent age group of 15 to 18 years and ES outnumbered the osteosarcoma in this age group. The common complaints were local swelling and pain at local site and the median duration of symptoms was 2 months.

RMS was the most common STS in children that represented one half of childhood STS, while the other half was collectively called as non-RMS that included fibrosarcoma, dermatofibrosarcoma protuberance, synovial sarcoma, liposarcoma, epithelioid sarcoma, and malignant peripheral nerve sheath tumor. RMS was predominant in age group of 0 to 5 years. Among non-RMS, fibrosarcoma was more frequent in infants, while other non-RMS were seen in adolescent age.¹⁸ In this study, RMS was the most common STS constituting 76.1% of all the STS patients. With respect to the age of presentation, majority (64.3%) of patients in this study were in the age group of 10 to 18 years that differs from that of the Western literature. STS usually presented with painless local swelling and was found in majority (73.8%) of STS patients included in our study.¹⁸

Childhood malignant germ cell tumors (MGCT) was a group of heterogeneous tumors that represented 3% of all childhood cancers.²³ These tumors clinically presented with abdominal swelling, pain abdomen, or as a scrotal swelling and are more prevalent in adolescent age group. MGCT in this study was seen in 45 patients that represented 5.9% of total pediatric malignancy. Maximum number of patients (20; 44.4%) were in the adolescent age group of 15 to 18 years.

In this study of pediatric malignancy, the incidence, age of presentation, and clinical symptoms were similar to that of the Western literature except the clinical presentation of HL and age at presentation of RMS.

Limitation

This study does not provide data regarding the outcome and survival of pediatric malignancy patients who received treatment during the study period due to discontinuation of treatment and lack of follow-up by patient's family.

Conclusion

This study gives an insight to the clinicodemographic pattern of pediatric malignancies of the state of Odisha for 8 years (2013–2020). The most common malignancy in this study was childhood leukemia followed by malignant bone tumors and lymphoma, while retinoblastoma was the least common. Childhood leukemia followed by CNS neoplasm was predominant in the age group of 0 to 9 years; leukemia and lymphoma were seen in all the age group 10–14 years, while malignant bone tumors were seen commonly in adolescent age group of 15 to 18 years. Males outnumbered females and the frequency of detection of childhood malignancy were more in the districts that had access to tertiary care hospitals.

Authors' Contributions

All authors contributed to the study conception and design. Data collection and analysis were performed by A.A., S.S., T.K.D., and A.K.S. The statistical analysis and manuscript preparation were done by D.R.S., S.N.S., and A.A., All authors edited and reviewed the manuscript.

Ethical Conduct of Research

The study was approved by the Institutional Ethics Committee of Acharya Harihar Post Graduate Institute of Cancer, Letter No: 05-IEC-AHPGIC.

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None.

Conflict of Interest

None declared.

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